U.S. PATENT DOCUMENTS CITED:

U.S. Patent No. 3,629,600: EMERGENCY TRAFFIC LIGHT CONTROLLER

U.S. Patent No. 3,933,354: REFLEX TESTING AMUSEMENT DEVICE

U.S. Patent No. 4,702,475: SPORTS TECHNIQUE AND REACTION TRAINING SYSTEM

U.S. Patent No. 5,325,340: PACING DEVICE

U.S. Patent No. 5,812,239: METHOD AND ARRANGEMENT FOR THE ENHANCEMENT OF VISION AND/OR HAND-EYE COORDINATION

U.S. Patent No. 5,897,457: ATHLETIC PERFORMANCE MONITORING SYSTEM.

U.S. Patent No. 6,066,105: REFLEX TESTER AND METHOD FOR MEASUREMENT

U.S. Patent No. 6,287,378 B1: PERFORMANCE AND ENTERTAINMENT DEVICE AND METHOD OF USING THE SAME

SPECIFICATION

TITLE OF INVENTION

Method and device for introducing state changes into athletic activities.

CROSS-REFERENCE TO RELATED APPLICATIONS

Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

REFERENCE TO SEQUENCE LISTING , A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISK APPENDIX

Not Applicable.

BACKGROUND OF THE INVENTION.

Most athletic activities require the participants to respond rapidly to changes in their environment. For instance, they must constantly reevaluate their course of action depending upon their own velocity and position and that of a ball, opposing players, and teammates. However in training, and especially in solo training, the environment tends to be largely static. In the game known as soccer in the U.S.A, and football elsewhere, a common training drill consists of a player dribbling a ball around a series of cones or other similar markers. Such variation as exists consists of predetermined decisions such as to alternate between passing on the left on one cone and on the right on the next. Effectively such training exists within an invariant environmental state.

The disadvantage of such a drill is that it does not train athletes to constantly observe, analyze, and react, as they must in a real game. The present invention allows the introduction of transitions between multiple environmental states, such transitions being either strictly periodic or randomly varying in frequency, enabling in training situations a better simulation of the timing and thought processes of the game in question. The invention also allows new types of games to be created and played which incorporate the varying states expressed by the device into the play of the game. The invention accomplishes these goals by maintaining a time varying internal state which is transmitted to athletes, typically via a visual method such as colored lights, so that the athletes may interpret these signals as a change in the training or game environment. In the soccer training drill the invention would replace the traditional practice cone and would indicate to the player the manner in which the ball should be passed around the obstacle.

The intentional introduction of transitions between multiple contest states is common in arcade and video games and other electronic entertainment but there is little precedent for this in athletics. The only common examples occur at or before the actual contest: the opening toss of a coin before a game or the drop of the flag in an automobile race. In music the periodic signal from a metronome is often used and there may be instances where the signal from such a metronome has been used to aid athletes synchronize their movements to music. That differs from the utility of the present invention, which is not synchronization, but the presentation of varying training or game states to the athlete.

The following U.S. patents disclose concepts that bear some relation to the present invention. However, none of the cited prior art discloses an invention having the versatility or utility of the present invention.

Stuler U.S. Pat. No. 3,629,600 discloses a battery powered traffic light controller. This and other traffic controllers differ markedly from the device of the current patent application. Such controllers transition between their 3 states (green, yellow, red) in a single fixed order. Additionally, these transitions are either triggered by external sensors or occur at fixed time intervals. The present invention does not use external sensors to trigger state transitions. Instead, a large repertoire of randomly varying state transitions useful in athletic training is provided. The traffic controllers would be predictable and useless for injecting variation into athletic training. Conversely, the device of the present patent, when configured appropriately for athletic training, would lead to havoc if utilized as a traffic controller.

Ramsey U.S. Pat. No. 5,325,340 discloses an athletic training device which is utilized for pacing. Its function is the antithesis of that of the device of the present patent application. The pacing device produces a certainty. It tells the athlete exactly where to be at a given time and even goes so far as to provide a correction signal when the athlete is too far ahead or behind. The present device produces an uncertainty. Its purpose is to present a signal which is variable and unpredictable. Moreover, the feedback circuit of Ramsey's device requires a measurement of the athlete's position. No such measurement is required or supported by the present invention.

Goldfarb et al. U.S. Pat. No. 3,933,354 discloses a martial arts amusement device in which a light at one of ten positions on a picture of a combatant is lit. When a player strikes that position the light turns off, the player's score is incremented, and the game lights another region on the simulated combatant. The lights are selected from a pattern sufficiently complex to appear in random order to the player. This is a one or two player game. This invention is primarily a game rather than a serious athletic training device and it is described in very narrow terms without any general application to other types of athletic training or contests. This invention requires constant input from the player - the game will lock in any device state where a lamp is lit unless the player strikes the lit part of the display to allow it to transition to the next state. The designers recognized that a detector failure would render the game inoperable and provided a failsafe mechanism to transition should that occur - but such a transition is not a normal operating mode of the invention. In comparison, the invention of the present patent application, as it might be implemented for martial arts practice, would have lit one or more lamps for short periods of varying duration during which a lit lamp would have been a target for the athlete. The device would then have transitioned to another device state whether or not the athlete succeeded in striking the target.

Elstein et al. U.S. Pat. No. 4,702,475 disclose a sports technique and reaction training system in which a particular movement pattern is to be executed by the participant in a given amount of time in response to a start signal that determines which of several such patterns is to be executed. This invention requires that the participant

return to a base position to trigger another training cycle - so that the time required to complete the movement pattern may be measured. Moreover, the purpose of the invention is to train the participant to carry out a choreographed set of motions in minimal time. The present invention is very different. Some of the differences are: the position of the athlete with respect to the device is not fixed (there are no intrinsic start and stop positions); the device runs independently of the athlete's actions (other than setting it and turning it on, the athlete would not normally affect the state of the device); more than one device could be simultaneously employed in training or during a game by an athlete or athletes; and the utility of the invention is to provide state transitions in training to better simulate actual play, or in play, to provide more variety to the game, but not to improve the performance of a predetermined choreographed set of motions.

Other instances of the class of athletic measurement devices examined in detail in the preceding paragraph are disclosed in Mackovjak U.S. Pat. No. 5,897,457, Guillen U.S. Pat. N. 6,066,105, and Feiner et al. U.S. Pat. No. 6,278,378. These devices all differ from the present invention in requiring two trigger events: one to initiate a measurement and a second one to indicate its termination. The devices then report the performance in some manner. The present invention utilizes no triggers, does not measure performance in any way, and is used in an altogether different manner than any of these devices.

Eger U.S. Pat. No. 5,812,239 discloses a visual training device comprising a plurality of LEDs under microprocessor control, and in some embodiments, sensors and additional optics. In all embodiments the user stands at a fixed position with respect to

the device and looks at LEDs as they are lit. In some variations of this embodiment the user is further required to peer through special optics at the same time. This may be an exemplary eye training device of utility in an optometrist's office. However, a person standing in a fixed position and rolling her eyes is not generally considered to be either training for, or participating in, an athletic endeavor. Most critically in its most basic form this device neither elicits nor allows significant bodily motion and consequently has little utility in athletic training. The more active embodiments disclosed are designed to measure reaction time in response to the same visual stimulus. As such, these require at least one sensor, which acts as a trigger, and as described above for other similar measurement devices, differ in fundamental ways from the present invention.

BRIEF SUMMARY OF THE INVENTION

This device is to be employed in the training of athletes and the playing of athletic games. During these activities athletes observe and respond to signals that vary with time and are generated and displayed by the device. In this manner the device adds a new element to athletic training and enables new types of sports to be played.

SUMMARY OF THE INVENTION

The present device provides for one or more logical states to be continuously varied, either periodically or randomly, and for this state information to be transmitted to one or more athletes for the purpose of varying the training or game environment. The athlete would perceive this information either visually or aurally as appropriate for each sport. For a specific example consider again the soccer drill described above. This device would either adorn or replace the typical cone marker and would maintain an integer variable which would transition its four allowed states in a periodic, random, or pseudorandom pattern. This information would be conveyed to the athlete visually - for instance, by providing two rings of light around the cone, one blue, one red, which are lit according to the value of the matching state variable. Together these two state variables would encode four device states with the local (to this cone) meanings "Pass on Left", "Pass on Right", "Pass on Left or Right", and "Do not Pass". The time fraction the device spends in each state would be adjustable, as would be the mean frequency of the transitions between these device states and the minimum hold time spent in each device state before a transition would be permitted. An athlete approaching the cone would

observe the state of the device and respond as appropriate. Even this simple four state training device could easily be employed in numerous other drills in this and other sports. For instance, the same four state device placed at the top of the basketball key could indicate "left side layup", "right side layup", "shoot from the top of the key", or "shoot immediately." In baseball it might tell a pitcher to throw a curve, slider, fastball, or to throw out the runner at first base. The invention may also be used to globally alter the rules of the athletic contest or practice. Examples: "when the red light is lit players may not shoot on goal" or "player number 5 may shoot".

BRIEF DESCRIPTION OF THE DRAWINGS

The manifestation of the present invention will necessarily vary depending upon the particular sport. This is particularly true when considering aquatic versus terrestrial playing environments. To illustrate this invention a preferred embodiment is presented for use in the context of a terrestrial game like soccer.

Figure 1 Side view of the exterior of the preferred embodiment.

Figure 2 Block diagram of the mechanism of the preferred embodiment.

Figure 3A. Block diagram of a line powered remote controller with microphone, speaker, and transmitter receiver.

Figure 3B. Block diagram of a display unit with microphone, speaker, symbolic display, and transmitter receiver.

Figure 4A. Alphanumeric display unit worn by athlete.

Figure 4B. Alphanumeric display unit attached to a piece of sports equipment.

Figure 5. Multiple display units with a single remote controller.

Reference Numerals Used in the Drawings:

10. Ring of Red Light Emitting Diodes

20. Ring of Blue Light Emitting Diodes

30. Plastic Cone

40. Removable Battery

50. Controller

60. Power Switch

70. Frequency Dial

80. Hold Time Dial

90. DIP Switch DP1

100. DIP Switch DP2

110. Line Power

120. Speaker

130. Microphone

140. Transmitter Receiver

150. Symbolic Display

160. Alphanumeric Display

170. Wearable Case.

180. Attachable Case.

190. Article of sporting equipment.

200. Athletic field with a plurality of display units

210. Current Device State of Remote Controller

220. Remote Controller

230. Display State.

240. Athlete

250. Transmission from remote controller to display units

260. Display Unit

270. Communications Selector

280. Previous Device State of Remote Controller

DETAILED DESCRIPTION OF THE DRAWINGS.

Figure 1 is a drawing of the exterior of the preferred embodiment of the invention. There are two rings of colored light emitting diodes (LEDs) on the device, a red one located near the cone's tip **10** and a blue one **20** located near the middle of the cone. The remainder of the exterior of the device is composed of a strong and durable plastic case **30** in a contrasting color such as yellow or light orange.

In this description the term "device state" refers to the value maintained by the device of a specific integer number which is encoded by at least one bit. In this first embodiment this integer has two bits and so the device state can takes one of four values. A transition is when the device state takes any of the four allowed values, including the

one it had previously. The device "changes state" when it moves from one of these four allowed values to a different allowed value.

Figure 2 shows a block diagram of the mechanism. A removable battery **40** provides power. It is connected to a small controller **50**. This is a typical embedded microprocessor based controller that reads its program from internal read only memory. When power is applied via an ON/OFF switch **60**, and at one second intervals thereafter, the controller reads the desired device settings from the configuration devices, two dials **70**,**80** and a pair of 8 position DIP switches DP1,DP2 **90**,**100**, and uses its internal program, the value of the device state, and this setting information to drive the red **10** and blue **20** sets of display LEDs. The Frequency Dial **70** controls the mean frequency at which the device may change state, which can be varied between 600 transitions per minute and 0.1 transitions per minute. The Hold Time Dial **80** sets the minimum hold time a device state must be maintained before a state transition is allowed and is variable between 200 milliseconds and 5 minutes. The switches on DP1 **90** and DP2 **100** control the device in the following manner:

DP1,0 determines if the transitions are periodic (fixed rate) or randomly varying around a mean frequency.

DP1,1 determines the device state order as sequential {0,1,2,3,0...} or random.

DP1,2-4 determine the occupancy for device state 0

DP1,5-7 determine the occupancy for device state 1

DP2,0-1 unused

DP2,2-4 determine the occupancy for device state 2

DP2,5-7 determine the occupancy for device state 3

The occupancy values set on DP1 **90** and DP2 **100** are integers in the range 0 through 7. The total occupancy for the system is the sum of the four device state occupancies. For instance, if these values were 0,5,3,2 (for states 0 through 3, respectively) the device would never enter state 0, would spend 50% of its time in state 1, 30% in state 2, and 20% in state 3. To vary only between states 1 and 2, and spend equal time (on average) in each the setting would be 0,N,N,0 where N is between 1 and 7. It is assumed that situations will arise where the invention will also be used as a static marker in fixed state. To lock the device into state 2 the occupancy values would be set at 0,0,7,0.

When used in the soccer dribbling drill application a typical setting might be: random transitions with a mean frequency of 15 transitions per minute, a minimum hold time of .5 seconds, random device state order, and occupancies set to 2,7,7,2. The mean period (MP) is the inverse of the mean frequency. Here the hold time (HT) of 0.5s is less than the MP of 4s, so a random number (RN) valued in seconds between 0 and 2*(MP-HT), here 7s, is generated by the controller. The next transition is then calculated at HT + RN seconds later. If HT had been more than MP the time offset to the next transition would have been equal to MP. When a transition is determined a second random number between 1 and 18 (the total occupancy) is generated by the controller. The next device

state is then determined by this random value as follows: 0 for {1,2}, 1 for {3,4,5,6,7,8,9}, 2 for {10,11,12,13,14,15,16}, 3 for {17,18}.

Table 1 shows the states of the signal lights and their interpretation by the athlete. The first column indicates the state of the red LEDs, the second column the state of the blue LEDs, the third column the device state, and the fourth column the interpretation of the device state to be made by the athlete within the context of a soccer dribbling drill.

TABLE 1

Red Lights	Blue Lights	Device State	Meaning to player
off	off	0	Do not pass
on	off	1	Pass on right side
off	on	2	Pass on left side
on	on	3	Pass on either side

Figure 3A shows a block diagram of an alternative embodiment where the remote controller comprises a line power source **110** and switch **60**, electronic controller **50**, Frequency **70** and Hold Time **80** Dials, two DIP switches **90**, **100**, speaker **120**, and microphone **130**. These are physically separate from the display unit described below in Figure 3B and communicate with it via a transmitter receiver **140**. The logical operation of the device is as described above except that the controller **50** in this embodiment also acts to record and transmit sounds detected by the microphone **130** through the transmitter receiver **140**, and to play sounds received through the transmitter receiver **140** on the speaker **120**.

Figure 3B shows a block diagram of an alternative embodiment of the display unit, comprising a battery power source **40** and switch **60**, speaker **120**, microphone **130**, symbolic display **150**, and a transmitter receiver **140**. The components act substantially as described above except that the controller **50** in the display unit, known as the display controller, simply relays the device state information of the remote controller of Figure 3A to the symbolic display **150**, which replaces the LED rings of Figure 1 and Figure 2. The four device states of Table 1 would be displayed here as symbols, one of which is shown in the figure, indicating by the left arrow that the player must go left.

A second embodiment utilizes exactly the same configuration shown in Figures 3A and 3B but with different programs loaded in the controller and display controller. In this variation the device state is maintained by the display controller in the display unit. The controller in the remote controller serves primarily to read the configuration devices and to pass those settings to the display unit. When acting in this lesser capacity the remote controller will be referred to as a remote control. The multiple display unit device illustrated in Figure 5 is described below only with a remote controller because the remote control variation requires no hardware changes, only reprogramming of the controller.

Figure 4A shows an alternative embodiment of the display unit as a device wearable by the athlete. This device is logically identical to the embodiment of Figure 3B except that the symbolic display **150** has been replaced by an alphanumeric display **160**. That is, instead of a left arrow the alphanumeric display **160** shows text, in the figure,

"Pass on left". A wearable case **170** in this embodiment allows the athlete to don the device, which, of course, could also be carried. The design of the case will necessarily vary considerably from sport to sport. Here the case **170** is shown fastened to the athlete's wrist.

Figure 4B shows an alternative embodiment of the display unit as a device attached to an article of athletic equipment **190**. The exact design of the attachable case **180** will necessarily vary with the type of equipment it is to be attached to. Here the case shown is substantially the same as the wearable case **170** of Figure 4A, which being suitable for attachment to a wrist, will also be suitable for attaching to cylindrical equipment of roughly the same diameter as a human wrist.

Figure 5 shows an alternative embodiment where a plurality of display units **260** are arrayed on an athletic field **200** and are controlled from a single remote controller **220**. In the training exercise illustrated the athlete **240** moves to guard the single blue lit display unit and ignores any other lit display units. Externally each display unit **260** resembles the entire device of Figure 1 and comprises a ring of red LEDs **10**, a ring of blue LEDs **20**, a durable plastic case **30**, and an additional component, a transmitter receiver **140**. Internally the display units are logically essentially as described in Figure 3B, in this instance with the minor substitution of rings of LEDs **10,20** for the symbolic display **150** of Figure 3B.

The display state **230** of each display unit **260** corresponds to a portion of the device state **210** of the remote controller **220**. For this illustration the current device state

210 of the remote controller **220** is presented as 9 values of 2 bits each and their 1:1 correspondence via the logic of Table 1 to the current display state **230** of the various display units **260** is evident. The preceding device state **280** is also shown. In the preceding moment the central display unit was blue. Following a device state change the athlete is moving to guard the display unit which is currently blue, having ignored in both instances the single red display unit. The device state is transmitted **250** via the transmitter receiver **140** to the plurality of display units on the field **200**, each of which then takes on the display state **230** which corresponds to its portion of the device state **210**. There are numerous well known methods available for dynamically mapping parts of the device state **210** to particular display units **260**. In this simple embodiment static mapping is employed: this information is set in the controller inside each display unit at the time of manufacture.

The remote controller **220** is essentially the same as that shown in Figure 3A, with a few minor enhancements to allow it to control more than one display unit at a time. One possible arrangement of the exterior features is presented showing the speaker **120**, microphone **130**, power switch **60**, transmitter receiver **140**, and the configuration devices. The configuration devices include the Frequency dial **70**, Hold time Dial **80**, DIP switches DP1 **90** and DP2 **100**, and the large DIP switch which is the communications selector **270**. Several training options programmed into the controller provide a variety of exercises. To toggle between these modes the previously unused DIP switches DP2,0 and 1 are now employed to set the controller as described in Table 2.

TABLE 2

DP2,0	DP2,1	Device State
open	open	All display units transition together to the same state.
closed	open	Each display unit transitions independently
open	closed	Display units transition sequentially
closed	closed	Cycle between preprogrammed sequential actions

The first of these modes is equivalent to a single device of Figure 1 reflected on the field multiple times. The second mode is equivalent to the deployment on the field of multiple independent instances of the device of Figure 1. The third mode activates display units sequentially in a predefined or random order so as to present a localized signal that moves in a one, two, or three dimensional pattern across a playing area. As in the device of Figure 1, the randomly timed transitions prevent the athlete from predicting the moment when the next change will occur. In Figure 5 the athlete on the field moves to "guard" the single blue cone, where the order in which the cones are lit simulates the erratic motions of a moving offensive player. The fourth mode cycles slowly through the activation patterns which are available for the third mode. The controller stops cycling, locking in the current pattern, when DP2,0 is set back to the open.

The communications selector (CS) **270** is read by the controller in a manner similar to the other DIP switches. The CS allows communications to be selectively targeted to any subset of the display units or broadcast to all of them. The CS has a plurality of switches. When CS 0 is set broadcast is enabled allowing sound communication with all devices. When CS 0 is not set communication is selectively

controlled by the other CS switches. For instance, when CS 1 is set sound communication with the first display unit is enabled, otherwise, it is disabled.

One preferred embodiment and several variations of the device have been described here in detail to comply with the Patent Statutes and to prove that this device could be constructed by one skilled in the arts. It is emphasized that numerous other implementations of the invention are possible, none of which depart from the scope of the invention itself. These include, but are not limited to: utilizing similar or different implementation technologies; utilizing similar or different implementation details; customizing for one or more different sports; utilizing more or fewer device states; utilizing other display technologies; utilizing other configuration devices technologies; and utilizing physically larger or smaller devices.

ABSTRACT OF THE DISCLOSURE

A device is described for introducing variation in athletic training and competitive events. This device maintains an internal state which occupies one of several allowed values. Depending upon the selected configuration, the device changes internal state at regular or irregular intervals, progresses through its allowed values sequentially or in random order, and spends a different designated fraction of time in each state. This variable and typically unpredictable state is transmitted or presented to the field of play where one or more athletes receive the information and react to it as a change in their athletic training or game environment. One form of the device coordinates multiple independent displays so that the signal corresponding to the internal state appears to move from display to display across the field of play.